

WHAT IS CLAIMED IS:

1. A semiconductor device having a protection circuit, comprising:

an NPN type bipolar transistor having a collector and an emitter connected between an external connection terminal and a reference terminal of a semiconductor device to be protected;

a PMOS transistor having a drain terminal and a source terminal connected between a base and the collector of the NPN bipolar transistor and configured to supply a base current to the base of the NPN type bipolar transistor; and

a control circuit configured to supply a control signal to a gate of the PMOS transistor in response to a voltage emerging on the external connection terminal.

2. A semiconductor device according to claim 1, wherein a resistor is connected between the base and the emitter of the NPN type bipolar transistor.

3. A semiconductor device according to claim 1, further comprising an NMOS transistor having drain and source terminals connected between the base and the emitter of the NPN type bipolar transistor and a gate terminal supplied with a control signal of the control circuit.

4. A semiconductor device having a protection circuit, comprising:

an NPN type bipolar transistor having a collector

and emitter connected between a data input/output terminal of a semiconductor device to be protected and a reference terminal;

5 a control circuit configured to output a control signal in response to a voltage emerging on a data input/output terminal; and

10 a logical circuit having an output terminal connected to a base of the NPN type bipolar transistor and configured to perform a logical operation based on a voltage on a power supply terminal of the semiconductor device to be protected and the control signal of the control circuit and to supply a base current from the output terminal to the base of the NPN type bipolar transistor.

15 5. A semiconductor device according to claim 4, wherein said logical circuit includes an NOR circuit configured to receive a voltage on said power supply terminal and the control signal of said control circuit.

20 6. A semiconductor device according to claim 1, wherein said control circuit has such a function as to, when a voltage higher than a predetermined voltage is applied to said external connection terminal, operate the PMOS transistor upon receipt of that voltage to
25 supply a base current to the NPN type bipolar transistor and, as that higher voltage on said external connection terminal becomes lower, to turn the base

current which is supplied from the PMOS transistor OFF.

7. A semiconductor device according to claim 1,
wherein said control circuit includes a resistive
element and a capacitor serially connected between said
5 external connection terminal and the reference
terminal.

8. A semiconductor device according to claim 7,
wherein the resistive element of said control circuit
is connected between the gate of said PMOS transistor
10 and said external connection terminal and said
capacitor is connected between the gate of said PMOS
transistor and the reference terminal.

9. A semiconductor device according to claim 4,
wherein said control circuit includes a resistive
15 element and a capacitor serially-connected between the
power supply terminal and the reference terminal.

10. A semiconductor device according to claim 9,
wherein the resistive element of said control circuit
is connected between the data input/output terminal and
20 one input terminal of said logical circuit and the
capacitor is connected between said one input terminal
and the reference terminal.

11. A semiconductor device according to claim 4,
wherein said control circuit includes a resistive
25 element and at least one diode serially-connected
between said external connection terminal and the
reference terminal.

12. A semiconductor device according to claim 4,
wherein said control circuit includes a resistive
element and at least one diode serially-connected
between said data input/output terminal and the
5 reference terminal.

13. A semiconductor device according to claim 4,
wherein said logical circuit is configured, when
a normal operation voltage is supplied to the
semiconductor device to be protected, to be set at
10 a threshold value for retaining the NPN type bipolar
transistor in an OFF state.

14. A semiconductor device according to claim 1,
further comprising a first NMOS transistor for an
input/output buffer connected between said external
15 connection terminal and the reference terminal and
a second NMOS transistor connected as the protection
circuit for said input/output buffer connected between
said external connection terminal and the reference
terminal, wherein said NPN type bipolar transistor is
20 comprised of a parasitic NPN type bipolar element
having a P type region in the first NMOS transistor and
N type regions in the source and drain of the second
NMOS transistor.

15. A semiconductor device according to claim 4,
25 further comprising a first NMOS transistor for
an input/output buffer connected between said data
input/output terminal and the reference terminal and

a second NMOS transistor connected as a protection circuit for the input/output buffer between the data input/output terminal and the reference terminal, wherein the NPN type bipolar transistor is comprised of
5 a parasitic NPN type bipolar element having a P type region in the first NMOS transistor and two N type regions in the source and drain of the second NMOS transistor.

16. A semiconductor device having a protection
10 circuit, comprising:

an NPN type bipolar transistor having a collector and an emitter connected between a first power supply terminal and a reference terminal in the semiconductor device to be protected;

15 a control circuit configured to output a control signal in response to a voltage emerging on the first power supply terminal; and

a logical circuit having an output terminal connected to the base of the NPN type bipolar
20 transistor and configured to perform a logical operation based on a voltage on a second power supply terminal in the semiconductor device to be protected and the control signal of the control circuit and to supply a base current from said output terminal to the
25 base of the NPN type bipolar transistor.